

## DISTRIBUTION OF NATIVE AND INTRODUCED FRESHWATER FISHES IN THE BARWON RIVER AND ITS UPPER TRIBUTARIES, VICTORIA

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**ABSTRACT:** Twelve native and five introduced species of freshwater fishes were collected from 17 sampling sites on the Barwon River and its upper tributaries during the period April 1986–April 1987. Present distribution of fishes in the system is the result of clearing of vegetation, water abstraction and agricultural practices, construction of barriers affecting movement of fishes and the greater diversity of habitats downstream. Despite changes to the river and its catchment since European settlement, and despite the introduction of exotic species of fish, self-sustaining populations of native freshwater fishes have survived. A population of the grayling *Prototroctes maraena*, one of Australia's four most seriously-threatened species of freshwater fishes, was found. The mountain galaxias, *Galaxias olidus*, was recorded from the Barwon River for the first time. Some options for future management of the Barwon River are discussed in relation to some biological requirements of the existing fish fauna.

The Barwon River flows for more than 100 km from Forrest in the north-east of the Otway Ranges to Barwon Heads (38°17'S, 144°30'E) (Fig. 1). The river flows through extensive pasture-land for much of its length, and its lower reaches receive run-off and effluents from urban and industrial sources in Geelong.

Water flow in the Barwon has been regulated for more than 100 years for domestic and irrigation purposes. Proposals for additional abstraction of water to support the continued growth and future water requirements of the cities of Geelong and Warrnambool and regional townships are currently being considered (Geelong and District Water Board 1984, 1986). Reduction of flow in rivers can affect the distribution and abundance of resident fish populations by altering the amount of habitat available for fishes to live and reproduce successfully. Consequently, the Fisheries Division of the Ministry for Conservation, Forests & Lands was commissioned to determine the minimum flows that would satisfy the requirements of the fish fauna and, if provided, maintain existing fish populations in the Barwon River.

Knowledge of the distribution of sport fish in the Barwon River has been determined largely by netting surveys (Tunbridge & Rogan 1983, Baxter 1986) or from angling results. The distribution of the smaller forage fishes has not been investigated. In this paper the nature and distribution of fish within the Barwon River and its upper tributaries are described.

### METHODS

Three methods of fish capture were employed at each of the 17 sampling sites (Fig. 1, Table 1), usually at 3-monthly intervals during the 12 months April 1986 to April 1987. Selection of sampling sites was determined largely by available public access points to the river, as the greater part of the river frontage upstream from Buckleys Falls is private land.

Electrofishing with a Smith-Root Mark VIA model electrofisher (pulsed D.C. at 672 V) was undertaken during daylight hours. The length of stream sampled was determined by available shoreline access and nature of the water at the sampling site and ranged from 40 to 150 m.

A series of 8 mesh nets (38-127 mm diagonal stretch-mesh in 12.7 mm gradations) and two fyke nets (20 mm mesh size) were set overnight (1600-0800) for one night at each site.

Fishes were identified according to Cadwallader and Baekhouse (1983), and the total length (TL)—or length to caudal fork (LCF) where appropriate—of each individual was measured and recorded. Where identification was uncertain, specimens were preserved in 10% neutral formalin for later examination.

### RESULTS

Seventeen species of fish, 12 of which were native, were recorded during the survey (Table 2). In addition, platypus (*Ornithorhynchus anatinus*), freshwater crayfish (*Euastacus varraensis*) and freshwater shrimp (*Australatya striolata*) were recorded from the system.

Short-finned eels were present at all sampling sites indicating a widespread distribution throughout the river and its upper tributaries (Table 2). Common galaxias, redfin and brown trout were also present throughout most of the system. Freshwater blackfish, mountain galaxias and southern pygmy perch were caught only in waters upstream from site 5. Small-mouthed hardyhead and common carp were caught only at sites downstream of Buckleys Falls, although anecdotal reports from local farmers and fishermen suggest that carp are widely distributed throughout the River. Most of the remaining species were captured from sites 1-7. Ammocoetes of the pouched lamprey were taken from Site 3 only. The ammocoetes are probably more widely distributed throughout the River but were not captured at other sites because their burrowing habits (Potter 1980, Potter *et al.* 1980)

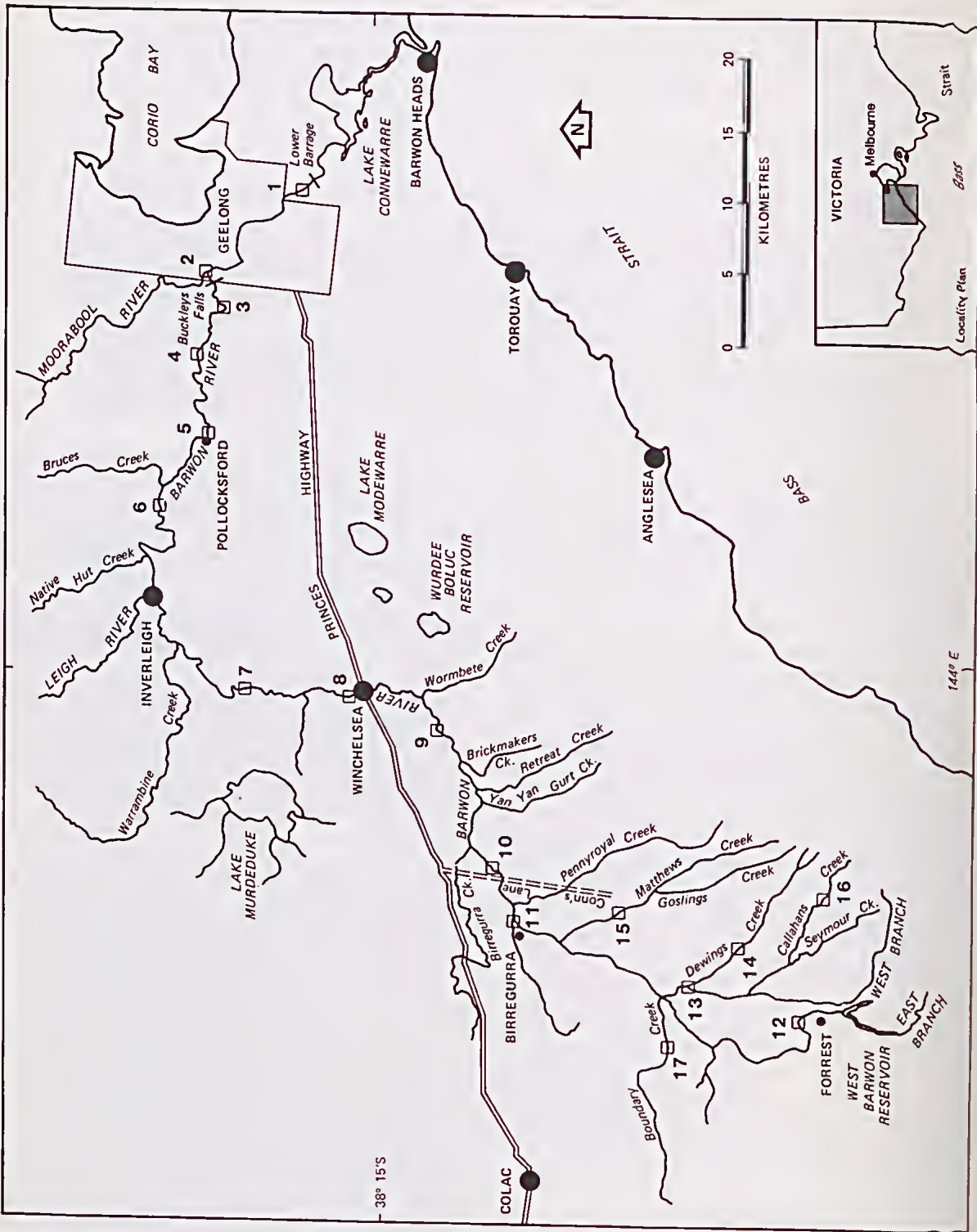


Fig. 1—Map showing sampling sites on the Barwon River and its upper tributaries.

TABLE I  
 DESCRIPTIONS OF INSTREAM CHARACTERISTICS AT EACH OF THE SITES SAMPLED FOR FISH ON THE BARWON RIVER AND ITS UPPER TRIBUTARIES.

Site No.	Name	Dominant substrate	Description/Comments
1	Lower barrage	M	Deep pool, turbid water
2	Below Buckleys Falls	M/C	Deep pool, turbid water
3	Fyansford	M/C	Deep pool, turbid water
4	Ceres Road	M/C	Deep, narrow pools
5	Pollocksford	S/B	Deep pools, shallow riffles
6	Near Inverleigh	R/C/S	Deep pools, short riffles
7	Falls	S/M	Deep, slow pools
8	Winehelsea	S	Slow pools, short riffles
9	Riverstation	S	Extensive riffles, short pools
10	Conns Lane	M/C/S	Extensive pools, short riffles
11	Birregurra	S/M	Narrow, deep pools
12	West Branch (Forrest)	M	Narrow pools, short riffles
13	East Branch	M	Extensive shallow pools
14	Dewings Creek	M	Narrow, shallow runs
15	Matthews Creek	C	Shallow runs, few deep pools
16	Callahans Creek	M	Shallow runs, few deep pools
17	Boundary Creek	M	Narrow, shallow runs

M=Mud, C=Clay, S=Sand, B=Boulders, R=Rubble.

reduced their susceptibility to capture with the fishing methods used.

## DISCUSSION

Of the 17 species of fish caught during the study, one, the mountain galaxias, was recorded for the first time from the Barwon River. There was a larger number of fish species caught in the lower reaches of the River compared with the headwaters, probably reflecting a progressive increase downstream in the size and diversity of available habitat. Only seven species were collected from the upper tributaries and these were predominantly small fish such as common galaxias, mountain galaxias and southern pigmy perch, with the occasional short-finned eel and trout. Thirteen species were captured from the mid section of the River from Birregurra downstream to Pollocksford. This section contained most of the river blackfish encountered in the survey. The fish fauna downstream from Buckleys Falls consisted of 14 species and was characterised by the abundance of introduced species such as carp, tench and goldfish. The mosquito fish (*Gambusia affinis holbrooki*) and Macquarie perch (*Macquaria australasica*) have been recorded from the lower regions of the Barwon River (Cadwallader 1981, Raadik 1986), but none were encountered during the present survey. Redfin and brown trout were collected in greatest numbers from waters upstream of Buckleys Falls.

The absolute distribution—and also the relative abundance of species at different locations in the Barwon River—could not be accurately assessed from the sampling techniques used in the present study. More thorough sampling might have provided data

on relative abundance of species, but might also have had deleterious effects on the populations at each site.

A particularly interesting result was the large number of grayling downstream of Buckleys Falls. The small number of grayling collected above Buckleys Falls may indicate that the Falls presents a partial barrier to upstream movement of this species. Berra (1982) and Bacher and O'Brien (in press) suggest that grayling spawn in fresh water and that larvae and early juveniles develop in estuarine waters. If this is an accurate reflection of early life history requirements of grayling it is heartening that Buckleys Falls and the lower barrage near Lake Connewarre are not insurmountable obstacles for upstream migration of the species.

The grayling has, for some time, been considered one of the four most seriously-threatened, freshwater fish on the Australian continent (Lake 1971), and more recently its conservation status in Victoria has been defined as vulnerable (Cadwallader *et al.* 1984). In a comprehensive study of the life history and biology of grayling, Berra (1982) concluded that deterioration of habitat by siltation and the construction of barriers to the upstream movement could accelerate the decline of the species.

Much of the Barwon catchment is highly modified and water quality in the river (particularly salinity) has caused concern for some time (Geelong Water Works & Sewerage Trust 1979). The presence of grayling in the lower reaches of the river indicates adequate water quality for this species during the survey period. There are no specific data on the habitat or water quality requirements and tolerances of grayling. Therefore, the only recommendations that can be made for

TABLE 2  
 CONSERVATION STATUS, MEAN LENGTH ( $\pm$ SD) AND SITES OF COLLECTION FOR NATIVE AND INTRODUCED FRESHWATER FISH IN THE BARWON RIVER AND ITS UPPER TRIBUTARIES.

Species	Conservation Status	Mean length (mm)	Number of each species caught at site																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Native																				
Freshwater blackfish ( <i>Gadopsis marmoratus</i> Richardson, 1848)	A	228 $\pm$ 75			6	7	1	3	17	1	5	1								1
Southern pygmy perch ( <i>Nannoperca australis</i> Gunther, 1861)	G	51 $\pm$ 9									1	13	55	62	35	25	83	4		
Short-finned eel ( <i>Anguilla australis</i> Richardson, 1841)	A, Comm	435 $\pm$ 149	14	26	50	3	3	42	48	3	31	8	28	5	11	9	3	5	4	
Mountain galaxias ( <i>Galaxias olidus</i> Gunther, 1866)	G	61 $\pm$ 9									1	7	50	3						6
Common galaxias ( <i>Galaxias maculatus</i> Jenyns, 1842)	G	128 $\pm$ 36	778	14	44	6	25	17	2	6	2	7	2							16
Spotted galaxias ( <i>Galaxias truttaceus</i> Valenciennes, 1846)	C	123 $\pm$ 13				2														
Tupong ( <i>Pseudaphritis urvilli</i> Valenciennes, 1831)	G	243 $\pm$ 62	62	13	3	1														
Graying ( <i>Prototroctes maraena</i> Gunther, 1864)	C	196 $\pm$ 20	5	31	16	3														
Flat-headed gudgeon ( <i>Philypnodon grandiceps</i> Krefft, 1864)	G	78 $\pm$ 13	15	7	8	7	1													
Australian smelt ( <i>Retropinna semoni</i> Weber, 1895)	G	61 $\pm$ 6	1	2	85	100														
Small-mouthed hardyhead ( <i>Athermosoma microstoma</i> Gunther, 1861)	G	60 $\pm$ 32	1	1																
Pouched lamprey ( <i>Geotria australis</i> Gray, 1851)	D	—				7														
Introduced																				
English perch ( <i>Perca fluviatilis</i> Linnaeus, 1758)	A	280 $\pm$ 58	4	16	36	5	8	4	15	3	3	4	1	4						
Brown trout ( <i>Salmo trutta</i> Linnaeus, 1758)	A	357 $\pm$ 86	6	13	2	3	6	4	3	5	2	3	8	2						
Tench ( <i>Tinca tinca</i> Linnaeus, 1758)	A	363 $\pm$ 113	3	14	20	5	3	8												
Goldfish ( <i>Carassius auratus</i> Linnaeus, 1758)		154 $\pm$ 37	1	2	3	1														
European carp ( <i>Cyprinus carpio</i> Linnaeus, 1758)		342 $\pm$ 73	24	2																

Conservation status: A, Of angling importance; Comm, Of commercial importance; C, Restricted distribution, rare or both; D, *Indeterminate*, possibly *abundant*; E, Requiring careful monitoring; and G, Common and secure. (Categories of conservation status in Victoria as designated by Cadwallader *et al.* 1984)

conservation of the species in the Barwon system is the maintenance of existing, or improved, water quality and habitat.

Any changes to present patterns of water flow over existing or future river barriers in the Barwon River—particularly in the river's lower reaches—should be developed with knowledge of the probable requirement for upstream migration of juvenile grayling. The Barwon River contains a regionally-important breeding population of grayling that should be protected. Proposed construction of impoundments on rivers in Gippsland, which also contain remnant populations of grayling, adds importance to the maintenance of a substantial breeding population towards the western limits of the now restricted range of this species.

Tupong were mainly collected downstream of Buckleys Falls despite the presence of substantial areas of seemingly suitable, slow-water habitat upstream from the Falls. If tupong spawn in estuarine waters, as has been suggested by Cadwallader and Backhouse (1983), the distribution of this species in the Barwon River can be attributed—at least in part—to their inability to move upstream past Buckleys Falls.

Other native species found upstream from Buckleys Falls were the Australian smelt, short-finned eels, common, spotted and mountain galaxias, small-mouthed hardyhead and pouched lamprey. These species are known or are presumed to require access to and from estuarine waters to successfully complete their life cycle (Cadwallader & Backhouse 1983). Adequate flows of water over the Falls during the upstream migration periods of these species must be provided if maintenance of existing populations is a management objective.

In spite of substantial modification of the catchment and structure of the Barwon River since European settlement, populations of freshwater fishes of both angling and conservation value have survived throughout the system. Introduced species such as brown trout and redfin, which are of considerable recreational value, have spread along most of the length of the river. Other introduced species such as carp and tench which are also of considerable recreational value are concentrated in the river's lower reaches. Any proposals to improve existing facilities for upstream movement of fish in the Barwon River should consider the possibility of an upstream movement of common carp, tench and tupong and perhaps an increase in the numbers of these species in the middle reaches of the River.

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